Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

LIBRARY
BUREAU OF
INDUSTRY

FERTILIZERS *for* PECAN SOILS

LEAFLET NO. 71

Issued November, 1930

FERTILIZERS FOR PECAN SOILS

By J. J. Skinner, *Senior Biochemist, Division of Soil Fertility, Soil Investigations, Bureau of Chemistry and Soils*

Soils on Which the Pecan is Native

The native habitat of the pecan is in rich, low, overflowed river-bottom lands in the South-Central and Southwestern States. It is on these heavy soil types that pecans thrive and produce best in the southwestern pecan belt. Though the soils on which native pecans thrive are bottom lands it does not follow that the pecan tree can thrive and produce best on poorly drained soils. On the contrary, good drainage is essential for successful pecan production, and it is on the low-lying soils, which have a good watershed and drain well, that this choice nut is found at its best.

Pecan Soils of the Southeast

A great pecan-growing industry has developed on the loam and sandy loam soils of the upper coastal plain of Georgia, Alabama, and Florida, and to a lesser extent on the upper and lower coastal plains of North Carolina and South Carolina. The success of the industry depends to a great extent on the character of the soil in which the trees are planted, how the soil is utilized, and on its management, including fertilization. Although no specific soil type or soil class can be designated as having the best qualities for pecan culture, it is recognized that there are differences in the yield and quality of pecans produced on different soils. Although the soil type is an important factor, the essentials of soils necessary to success are good drainage, freedom from hardpan, and a high content of organic matter.

Soil Types

In the Southeastern States, the loams and sandy loams of the Greenville, Orangeburg, Ruston, Norfolk, and Bladen series have been selected as the better soil types for pecan growing. Deep, coarse sands and poorly drained sandy soils, such as the Leon, and soils having a hard, stiff subsoil, such as the Susquehanna, should be avoided. The types mentioned are among the principal soils in the southeastern section of the pecan belt.

Good-Quality Nuts Produced on Fertile Soils

In experiments conducted by the United States Department of Agriculture under similar cultural practices and other conditions, pecans produced on fertile Greenville and Orangeburg soils were generally larger, better filled, and richer in oil and protein than nuts grown on the less fertile Ruston, Norfolk, Leon, and Susque-

hanna soils. The nuts grown on poor Leon and Susquehanna soils were the poorest.

Green-Manure Crops and Fertilizers Essential

Practically all the soils of the southeastern pecan belt require the growing of leguminous crops for green manure and fertilization for the successful growing of pecans. When an orchard is planted some definite and consistent soil-building policy should be adopted. In young orchards a strip 10 or 12 feet wide on each side of the tree rows should be devoted to green-manure crops, such as velvetbeans and cowpeas in summer, and Austrian peas, wheat, and rye in winter. Cowpeas are a host crop for the smut bug which causes kernel spot of pecans and should not be grown in bearing orchards. The middles can be plowed and planted to farm crops. The strip devoted to green-manure crops should become broader each year, until the trees have reached an age of 9 or 10 years, when the entire orchard should be managed solely for the benefit of the trees. The title-page photograph shows a thrifty orchard growing a winter cover crop over he entire area for green manure. The practice of growing intercrops to be removed and sold without including a crop for green manure usually results in a poor and unprofitable orchard.

While there seems little question from the data available and from the large amount of work that has been done that fertilizers and cover crops are essential to successful pecan production, it might be questioned whether there is sufficient information at the present time to definitely recommend the type of soil management that will prove most successful. Whether permanent cover crops, two annual cover crops per year, or one winter cover crop with cultivation through the summer should be used is still an open question in the minds of pecan growers.

Fertilizer for Pecans

Experimental work with pecans has demonstrated that tree growth and nut yield can be increased by the proper use of commercial fertilizer, and successful growers of the Southeast now realize that correct fertilization is as essential to quality and profitable yields of pecans as of any other crop. The effect of commercial fertilizers on tree growth is shown in Figure 1.

FIGURE 1.—Four-year-old pecan grove on Kalmia sandy loam. Trees on left have received no commercial fertilizers; those on right have received annual application of a complete fertilizer since time of setting

9922°—30

Experiments conducted by the United States Department of Agriculture since 1918 to determine the proper fertilizer formulas and sources of fertilizers for the various soil types used in pecan growing in the South show that the ratio of nitrogen, phosphoric acid, and potash giving best results varies according to the soil type and orchard management. These experiments have shown that for pecan growing on loams and clay loams a liberal supply of nitrogen and phosphoric acid is needed, and that potash has but little effect on tree growth and nut yield. Orchards on sandy soils and very sandy loams require more potash, and fertilizers for such soil types should contain a good proportion of this constituent. For these latter soils potash and nitrogen have about equal value in nut production. Yields from trees fertilized with two and three fertilizer constituents are shown in Figure 2.

FIGURE 2.—Average yield per tree of 7-year-old Stuart pecan trees on Greenville sandy loam soil: A, no fertilizer, 4 pounds yield; B, phosphate-potash mixture, 5.9 pounds yield; C, nitrogen-potash mixture, 7.5 pounds yield; D, phosphate-nitrogen mixture, 9.4 pounds yield; and E, nitrogen-phosphate-potash mixture, 11.5 pounds

The fertilizer for the pecan orchard on most soils should contain all three of the fertilizer constituents, nitrogen, phosphate, and potash. In many of the experiments made by the department it was found that phosphate and nitrogen influenced tree growth and the yield, filling qualities, and size of the nut, and potash influenced the fat content, color, and plumpness of the kernel. Where considerable nitrogen has been supplied by growing and turning under leguminous cover crops, fertilizers containing 4 or 5 per cent nitrogen, 8 or 10 per cent phosphoric acid, and 3 or 4 per cent potash give good results on bearing trees. For soils of average organic matter and nitrogen content, a fertilizer containing 4 per cent nitrogen, 10 per cent phosphoric acid, and 3 per cent potash can be used with good results. For most soils, however, a mixture containing 5 per cent nitrogen is preferable, and for young orchards from the time of setting until they are 7 or 8 years old it is advisable to fertilize with a mixture containing even more of this element. A fertilizer containing 6 per cent nitrogen, 8 per cent phosphoric acid, and 4 per cent potash has been used generally by nurserymen and orchardists with success.

Fertilizer should be applied in early spring, shortly before or about the time the trees put out buds. It should be applied on the surface in a band around the pecan tree preceding cultivation. The operation of applying fertilizer in a large orchard and disking it into the surface soil is shown in Figure 3.

Under some conditions it may be advantageous to apply part of the fertilizers, principally phosphate and potash, when a summer cover crop is turned under in the fall and the remainder, principally nitrogen, in early spring.

Fertilizer Materials

In preparing a fertilizer mixture for pecans, consideration should be given to the materials used. Superphosphate is the principal source of phosphoric acid in mixed fertilizers and is the most widely used source of phosphorus. Ground rock phosphate and basic slags are used to some extent as separate applications but not in mixed fertilizer with nitrogen and potash. The effectiveness of ground rock phosphate is dependent on its fineness and on the incorporation of green manure in the soil. Its availability is slow. Basic slags if used year after year in large quantities tend to produce alkalinity in the soil, an objectionable reaction for pecan trees in the southeastern belt. The potash materials do not seem to vary widely in their effects. The sulphate, muriate, and manure salt are most widely used.

FIGURE 3.—Applying and disking in fertilizer in a pecan orchard in early spring before the trees bud

In harmony with general fertilizer practice and experience with pecans and general farm crops the fertilizer mixture ought to contain several sources of nitrogen such as nitrate of soda, sulphate of ammonia, or synthetic nitrogen materials, from which nitrogen is quickly available, and some fish scrap, tankage, blood, or cottonseed meal, from which it is slowly available. If it is desired to use a single source of nitrogen, such as nitrate of soda, in the fertilizer mixture it is advisable to apply quickly available nitrogen in the summer. In addition to the commonly used nitrogen materials, such as sodium nitrate, sulphate of ammonia, fish scrap, tankage, and cottonseed meal, there are a number of newer materials on the market, most of which are of synthetic origin. These are suitable for pecans, in mixtures with phosphate and potash and as separate applications. Among the more promising are urea (46 per cent nitrogen), calcium nitrate (15 per cent nitrogen), and ammonium phosphate (47 per cent phosphoric acid, 10.5 per cent nitrogen).

Fertilizer Mixtures

A fertilizer containing approximately 5 per cent nitrogen, 10 per cent phosphoric acid, and 3 per cent potash can be prepared by mixing the following materials in the quantities stated:

	Pounds
Superphosphate (16 per cent phosphoric acid)	1,250
Muriate or sulphate of potash (50 per cent potash)	120
Nitrate of soda (15 per cent nitrogen)	266
Sulphate of ammonia (20.5 per cent nitrogen)	195
Organic source (dried blood, tankage, etc.) (12 per cent nitrogen)	169
Total	2,000

In such a mixture the nitrogen is four-fifths mineral and one-fifth organic; it is derived two-fifths from sodium nitrate, two-fifths from sulphate of ammonia, and one-fifth from an organic material. Synthetic nitrogen materials could be used, but these should replace the mineral nitrogen and not the organic materials.

A mixture analyzing approximately 6 per cent nitrogen, 8 per cent phosphoric acid, and 4 per cent potash and suitable for young trees can be prepared by mixing the following materials:

	Pounds
Superphosphate (16 per cent phosphoric acid)	1,000
Muriate or sulphate of potash (50 per cent potash)	160
Nitrate of soda (15 per cent nitrogen)	266
Sulphate of ammonia (20.5 per cent nitrogen)	195
Organic source (dried blood, tankage, etc.) (12 per cent nitrogen)	333
Inert material	46
Total	2,000

In these fertilizers the nitrogen is derived two-thirds from quickly available materials and one-third from slowly available materials, a combination which is desirable for young pecan trees. Synthetic nitrogen could be substituted in part for the quickly available materials. Young pecan trees should receive from 1 to 2 pounds of fertilizer per tree for the first and second year after planting. The amounts applied should increase as the orchard becomes older. Growers usually apply from 8 to 10 pounds per tree to 5-year-old trees. For orchards 10 or 12 years old the amount varies from 40 to 50 pounds per tree or from 600 to 800 pounds per acre. Older trees generally receive larger applications. Frequently from 1,000 to 1,500 pounds per acre are used in well-developed orchards.

If it is desired to use a more concentrated mixture than a 5–10–3 [1] or a 6–8–4, these ratios of the fertilizer constituents should be maintained. Within the last few years a number of concentrated mixtures of complete, balanced fertilizers have become available in the fertilizer market and are sold under various trade names.

In the department's extensive pecan experiments on several thousand trees in the Southeastern States, the fertilizer requirements for pecans on some of the principal soil types have been studied, and

[1] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

some of these data, given in Table 1, show the increased yields of pecans that were secured.

TABLE 1.—*Results of fertilizer experiments with pecans*

Soil type and location	Area used in experiment	Variety	Age of tree	Time of experiment	Fertilizer analysis [1]	Fertilizer applied per acre	Increased yield per acre [2]
	Acres		*Years*	*Year*		*Pounds*	*Pounds*
Greenville sandy loam, Robertsdale, Ala.	10	Schley	11	First	5-9-3	600	40
Do	10	do	12	Second	5-9-3	600	72
Greenville sandy loam, Albany, Ga.	4	Stuart and Schley.	7	First	4-9-3	400	46
Do	4	do	8	Second	4-9-3	400	68
Do	4	do	9	Third	4-9-3	400	365
Do	4	do	10	Fourth	4-9-3	400	76
Do	4	do	11	Fifth	5-9-3	600	237
Do	4	do	12	Sixth	5-9-3	600	465
Greenville sandy loam, DeWitt, Ga.	1	Stuart	6	First	Complete fertilizer.[3]	150	24
Do	1	do	7	Second	do	200	116
Do	1	do	8	Third	do	400	28
Do	1	do	9	Fourth	do	400	66
Do	1	do	10	Fifth	do	500	56
Do	1	do	11	Sixth	do	700	200
Do	1	do	12	Seventh	do	800	312
Orangeburg sandy loam (A), Putney, Ga.	10	Schley, Alley, and Stuart.	9	First	do	150	60
Do	10	do	10	Second	do	200	70
Do	10	do	11	Third	do	260	109
Do	10	do	12	Fourth	do	400	95
Do	10	do	13	Fifth	do	600	69
Do	10	do	14	Sixth	do	600	111
Do	10	do	15	Seventh	do	700	178
Orangeburg sandy loam (B), Putney, Ga.	20	do	10	First	4-9-3	400	11
Do	20	do	11	Second	5-9-3	600	70
Norfolk sandy loam, Putney, Ga.	20	do	10	First	4-9-3	400	29
Do	20	do	11	Second	5-9-3	600	38
Do	20	do	12	Third	5-9-3	600	41
Norfolk fine sand, Jacksonville, Fla.	5	Moore	8	First	Complete fertilizer.[3]	400	46
Do	5	do	9	Second	do	500	128
Do	5	do	10	Third	do	500	42
Do	5	do	11	Fourth	do	800	332
Bladen fine sandy loam, Baldwin, Fla.	3	Curtis	8	First	do	400	41
Do	3	Schley	9	Second	do	600	160
Do	3	Stuart	10	Third	do	800	246
Do	3	do	11	Fourth	do	1,000	108
Do	3	do	12	Fifth	do	1,000	120
Do	3	do	13	Sixth	do	1,400	160

[1] Percentages, respectively, of nitrogen, phosphoric acid, and potash.
[2] The increase in yield is estimated by comparison with yield from plots which received no fertilizer.
[3] Six complete fertilizers were used having an average of 5-7-4.

Fertilizer of the grade used in these experiments may be valued at $30 a ton. Based on these data it is apparent that fertilizer applications give sufficient increase in yields to pay for the material used and also a profit, when the nuts are valued at 25 or 30 cents a pound. The yield of pecans from an unfertilized and a fertilized acre is shown in Figure 4.

Although the use of commercial fertilizers in pecan growing is profitable, it should be remembered that the fertility of the soil in pecan orchards can not be maintained by the use of commercial fertilizers alone; of equal importance are the growing of cover crops and the incorporation of organic matter. In the years before the trees begin to bear, the fertility and organic-matter content of the soil

should be built up. Before the tree roots have spread widely, summer and winter cover crops should be grown and the vegetation produced turned under. The planting of a leguminous cover crop for green manure together with the use of commercial fertilizers

FIGURE 4.—Yield from 8-year-old pecan trees with and without commercial fertilizers on Greenville sandy loam: A, pecans from 1 acre, without the use of fertilizer, 208 pounds, average 10.4 pounds of nuts per tree; B, yield from adjoining acre, with the use of 600 pounds of fertilizer per acre, 306 pounds, average 15.3 pounds per tree. Increased yield per acre was 98 pounds

should maintain the fertility of the soil sufficiently to support a successful orchard. Good soil, green manuring, proper tillage, and correct fertilization are important factors in successful pecan growing.

U. S. GOVERNMENT PRINTING OFFICE: 1930

For sale by the Superintendent of Documents, Washington, D. C. - - - - - Price 5 cents